

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 20 July 2000 (20.07.00)	
International application No. PCT/NO99/00299	Applicant's or agent's file reference
International filing date (day/month/year) 30 September 1999 (30.09.99)	Priority date (day/month/year) 30 September 1998 (30.09.98)
Applicant ARILD, Vik	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
28 April 2000 (28.04.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer Nestor Santesso</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

13

REC'D 29 DEC 2000	
WIPO	PCT

Applicant's or agent's file reference		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/NO99/00299	International filing date (day/month/year) 30.09.1999	Priority date (day/month/year) 30.09.1998
International Patent Classification (IPC) or national classification and IPC7 C01B 3/26, C01B 31/02, C09C 1/48, D11F 9/12, H01M 8/06, H01M 8/22		
Applicant Prototech AS et al		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of _____ sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input checked="" type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>

Date of submission of the demand 28.04.2000	Date of completion of this report 19.12.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Mattias Arvidsson/Els Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00299

I. Basis of the report

1. With regard to the elements of the international application:*

☒ the international application as originally filed☐ the description:

pages _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

☐ the claims:

pages _____, as originally filed

pages _____, as amended (together with any statement) under article 19

pages _____, filed with the demand

pages _____, filed with the letter of _____

☐ the drawings:

pages _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

☐ the sequence listing part of the description:

pages _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).☒ the language of publication of the international application (under Rule 48.3(b)).☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.☐ filed together with the international application in computer readable form.☐ furnished subsequently to this Authority in written form.☐ furnished subsequently to this Authority in computer readable form.☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. ☐ The amendments have resulted in the cancellation of:☐ the description, pages _____☐ the claims, Nos. _____☐ the drawings, sheet/fig _____5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00299

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☒ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

I. Claims 1-3 are directed to a method for producing hydrogen and carbon by pyrolysis of methane, with a carbon black catalyst.

II. Claim 4 is directed to a compact pyrolytic system, which is adapted to use in vehicles for producing hydrogen as fuel.

The special technical features of group I relate to carbon black catalyst, while the special technical features of group II relate to the use of a compact pyrolytic system. These groups of inventions are not so linked as to form a single general inventive concept. There is no technical relationship between these inventions involving one or more of the same special technical features.

The international preliminary examination report will be established on invention I (claims 1-3), which appears to be the main invention of the international application.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-3

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00299

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-3</u>	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	<u>1-3</u>	NO
Industrial applicability (IA)	Claims	<u>1-3</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention relates to a method and a device for production of hydrogen and carbon by pyrolysis of methane and other organic gases, utilising carbon dust as catalyst for precipitation of carbon in a closed process.

The following document is cited in the international search report as a document of particular relevance:

D: DD 118263 A1

Cited document D relates to a method for producing carbon by pyrolysis of gaseous hydrocarbons, preferably methane, on a moving bed of carbon particles in a two-zone reactor.

Claims 1-3

Document D discloses that gaseous hydrocarbons, heated by a counter-flowing hot gas, are decomposed to hydrogen and carbon. The carbon is deposited on the carbon particles which act as catalyst, thereafter the particles are cooled and then discharged (see claim 1). The document also discloses that a certain amount of the produced carbon particles is returned to the reaction chamber for further use in the process (see. p. 2 col. 2 line 32-33). The document further describes a insulated reactor in a fireproof material, which includes a casing of metal (see p. 3 col. 1 line 24 and claim 2), and that the counter-flowing hot gas is heated by a combustion chamber (in the application high temperature process) before it is introduced to the reaction chambers (see p. 2 col. 2 line 14-17).

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00299

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

The document does not disclose that the process is closed, which the application does.

According to document D, it is considered obvious for a person skilled in the art to use a method and device as described in claims 1-3.

Thus the invention as described in claims 1-3 lacks an inventive step.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO99/00299

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: **1-3**

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO99/00299

- I. Claims 1-3 are directed to a method for producing hydrogen and carbon by pyrolysis of methane, with a carbon black catalyst.
- II. Claim 4 is directed to a compact pyrolytic system adapted to use in vehicles for producing hydrogen as fuel

The special technical features of group I relate to carbon black catalyst, while the special technical features of group II relate to the use of a compact pyrolytic system. These groups of inventions are not so linked as to form a single general inventive concept. There is no technical relationship between these inventions involving one or more of the same novel technical features.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00299

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C01B 3/26, C01B 31/02, C09C 1/48, D11F 9/12, H01M 8/06, H01M 8/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C01B, D01F, C09C, H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PAJ, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DD 118263 A1 (H.-J. BÄNSCH ET AL), 20 February 1976 (20.02.76), page 2, column 2, line 30 - line 38, claim 1 --	1-3
X	WO 9840922 A1 (PROCYON POWER SYSTEMS INC.), 17 Sept 1998 (17.09.98), page 3, line 25 - line 33; page 8, line 20 - page 9, line 31; page 11, line 24 - line 30, page 14, line 31 - page 15, line 10, figures 4,5, claim 1, abstract --	4
X	WO 9808771 A2 (ARTHUR D. LITTLE, INC.), 5 March 1998 (05.03.98), page 1, line 11 - page 2, line 8, abstract --	4

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 February 2000

Date of mailing of the international search report

18 .02. 2000

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer

Mattias Arvidsson /ELY
Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00299

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5484978 A (GORAN J. HEDBERG ET AL), 16 January 1996 (16.01.96), claims 1,9, abstract --	1-3
A	US 4056602 A (EDWIN MATOVICH), 1 November 1977 (01.11.77), claims 1,2,5, abstract --	1-3
A	US 4738828 A (EDWARD F. BROOKS), 19 April 1988 (19.04.88), column 1, line 33 - line 36, claims 1, 6,14, abstract --	1-3
A	US 4946750 A (JAN F. NOMDEN ET AL), 7 August 1990 (07.08.90), column 1, line 4 - line 21, abstract --	4
A	EP 0345908 A1 (KTI GROUP B.V.), 13 December 1989 (13.12.89), column 3, line 38 - line 46, claims 1, 17, abstract -- -----	4

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/NO 99/00299

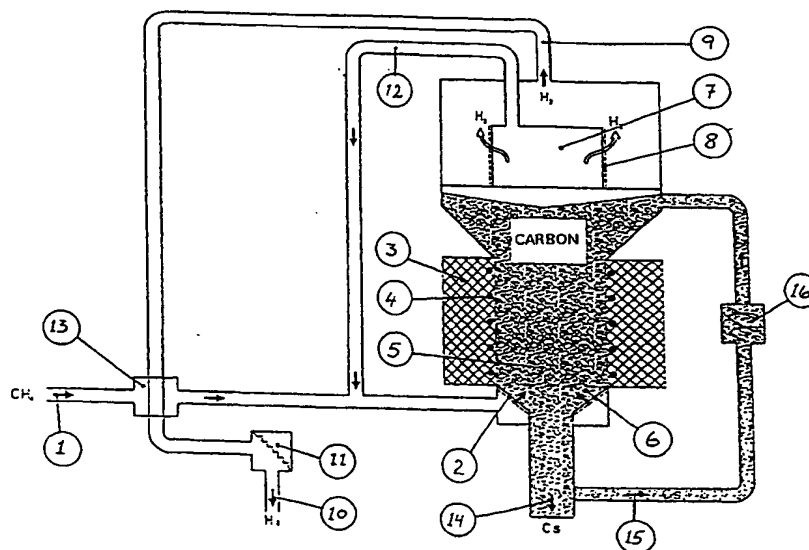
Patent document cited in search report			Publication date	Patent family member(s)		Publication date
DD	118263	A1	20/02/76	NONE		
WO	9840922	A1	17/09/98	AU	6465998 A	29/09/98
				US	5899175 A	04/05/99
WO	9808771	A2	05/03/98	AU	4161097 A	19/03/98
				EP	0922011 A	16/06/99
US	5484978	A	16/01/96	NONE		
US	4056602	A	01/11/77	US	4199545 A	22/04/80
				US	4095974 A	20/06/78
US	4738828	A	19/04/88	AT	51539 T	15/04/90
				AU	590736 B	16/11/89
				AU	5110885 A	26/06/86
				BR	8506339 A	26/08/86
				CA	1257246 A	11/07/89
				EP	0185548 A,B	25/06/86
				JP	1686896 C	11/08/92
				JP	3044812 B	09/07/91
				JP	61171531 A	02/08/86
				US	4583299 A	22/04/86
				US	4591334 A	27/05/86
				US	4743431 A	10/05/88
US	4946750	A	07/08/90	AT	109597 T	15/08/94
				CA	1321813 A	31/08/93
				DE	58908135 D	00/00/00
				DK	467489 A	27/03/90
				EP	0361612 A,B	04/04/90
				SE	0361612 T3	
				ES	2058480 T	01/11/94
				JP	2168570 A	28/06/90
				NL	8802357 A	17/04/90
				NO	176297 B,C	28/11/94
				NO	893797 D	00/00/00
EP	0345908	A1	13/12/89	SE	0345908 T3	
				AT	114205 T	15/12/94
				CA	1327629 A	08/03/94
				DE	68919380 D,T	24/05/95
				DK	279789 A	11/12/89
				ES	2067525 T	01/04/95
				JP	3184270 A	12/08/91
				NL	8801492 A	02/01/90
				NO	176339 B,C	05/12/94
				NO	892377 D	00/00/00



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : C01B 3/26, 31/02, C09C 1/48, D11F 9/12, H01M 8/06, 8/22		A1	(11) International Publication Number: WO 00/21878
		(43) International Publication Date: 20 April 2000 (20.04.00)	
(21) International Application Number: PCT/NO99/00299 (22) International Filing Date: 30 September 1999 (30.09.99) (30) Priority Data: 19984560 30 September 1998 (30.09.98) NO (71) Applicant (for all designated States except US): PROTOTECH AS [NO/NO]; Fantoftvegen 38, P.O. Box 6034, Postterminalen, N-5892 Bergen (NO). (72) Inventor; and (75) Inventor/Applicant (for US only): ARILD, Vik [NO/NO]; Slettenveien 76, N-5258 Blomsterdalen (NO). (74) Agent: CHRISTIAN MICHELSEN RESEARCH AS; Fantoftvegen 38, P.O. Box 6031, Postterminalen, N-5892 Bergen (NO).		(81) Designated States: AL, AM, AU, AZ, BA, BG, BR, BY, CA, CN, CU, CZ, DE, EE, GE, HR, HU, ID, IL, IN, IS, KG, KP, KR, KZ, LT, LV, MK, MX, NZ, PL, RO, RU, SI, SK, TJ, TM, UA, US, UZ, YU, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Norwegian).</i>	

(54) Title: PRODUCTION OF HYDROGEN AND CARBON WITH A CARBON BLACK CATALYST



(57) Abstract

The invention covers method, device and application of production of hydrogen and carbon by pyrolysis based on natural gas, methane or other organic gases as raw material. The method for precipitation of solid carbon is characterized by the use of finely distributed carbon dust as catalyst for the precipitation process. The device is designed as a reaction chamber that contains the catalyst. The temperature in the chamber is controlled by supply of electrical power or other energy. In addition the invention covers the application of compact pyrolysis systems in vehicles, for pre-processing of gases containing hydrocarbons and for fuel production for polymer fuel cells that generate electrical power for propulsion of the vehicle.

Box No.V DESIGNATION STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☐ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|---|---|
| <input checked="" type="checkbox"/> AL Albania | <input type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input type="checkbox"/> AT Austria | <input type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input type="checkbox"/> MG Madagascar |
| <input type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | <input type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BR Brazil | <input type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CA Canada | <input type="checkbox"/> NO Norway |
| <input type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CU Cuba | <input type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RU Russian Federation |
| <input type="checkbox"/> DK Denmark | <input type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia | <input type="checkbox"/> SE Sweden |
| <input type="checkbox"/> ES Spain | <input type="checkbox"/> SG Singapore |
| <input type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SI Slovenia |
| <input type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia |
| <input type="checkbox"/> GD Grenada | <input type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input type="checkbox"/> GM Gambia | <input type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> ID Indonesia | <input type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IN India | <input type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> IS Iceland | <input type="checkbox"/> VN Viet Nam |
| <input type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input type="checkbox"/> KE Kenya | <input type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input type="checkbox"/> LC Saint Lucia | |
| <input type="checkbox"/> LK Sri Lanka | |
| <input type="checkbox"/> LR Liberia | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☐
- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 30 sept. 98 (30.09.98)	1998 4560	Norway		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 19984560

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):	Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):
ISA / SE	Date (day/month/year) Number Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets: request : 3 description (excluding sequence listing part) : 4 claims : 1 abstract : 1 drawings : 1 sequence listing part of description : Total number of sheets : 10	This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet 2. <input checked="" type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):
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Figure of the drawings which should accompany the abstract: Fig. 1	Language of filing of the international application: <input checked="" type="checkbox"/> English <input checked="" type="checkbox"/> NORWEGIAN ▲
--	--

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

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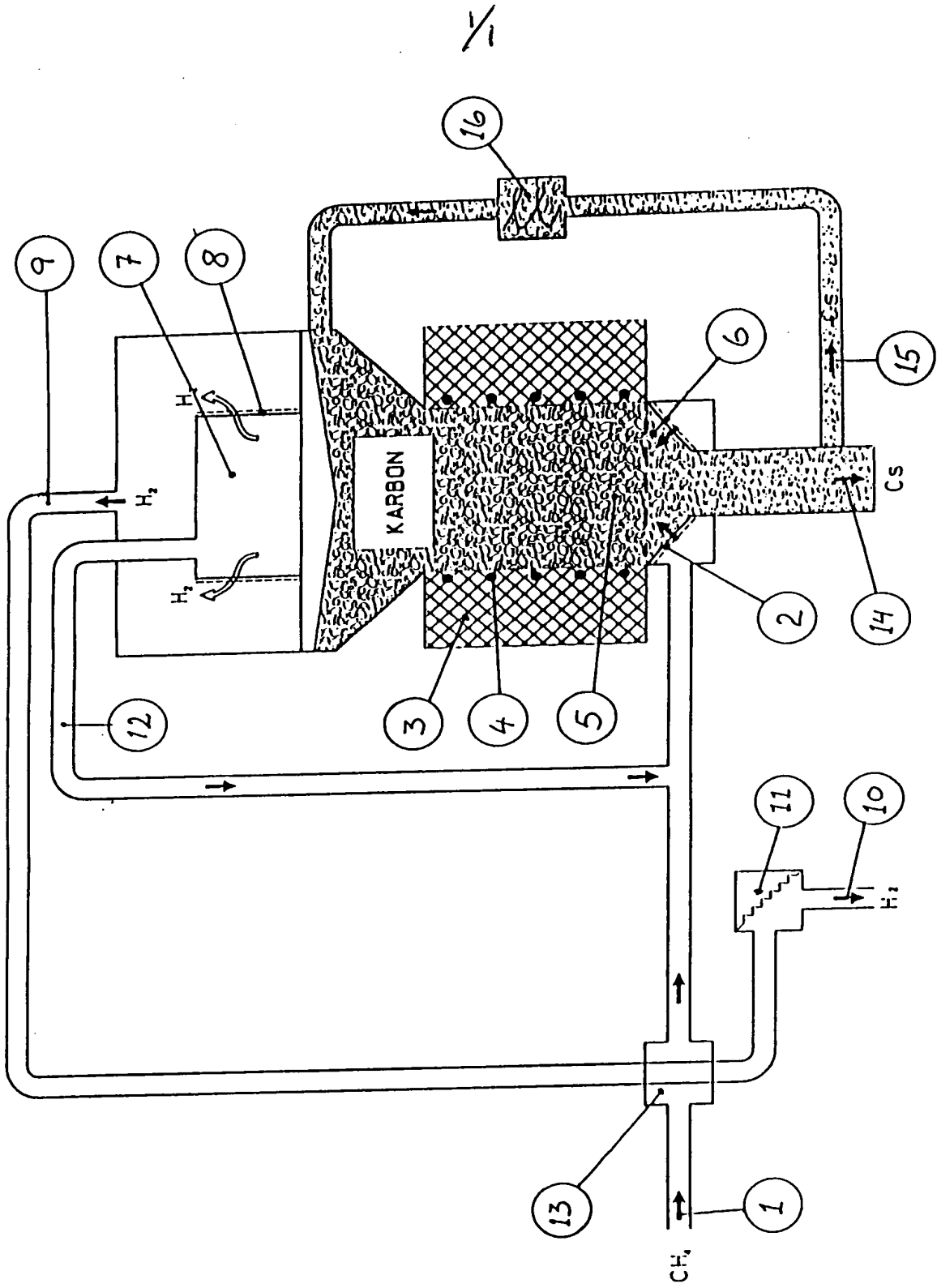


Fig. 1

Oppfinnelsen omfatter framgangsmåte, innretning og anvendelse for energieffektiv pyrolyttisk framstilling av hydrogen og karbon, basert på naturgass, metan- eller andre organiske gasser som råstoff.

Framgangsmåten for utfelling av fast karbon er karakterisert ved å benytte finfordelt karbonstøv som katalysator i utfellingsprosessen. Gassens karbonmolekyler binder seg til katalysatorens partikler på en slik måte at disse vokser til en utskilbar størrelse. Katalysatormaterialet blir fornyet gjennom kontinuerlig tilførsel av oppmalt karbon fra prosessen.

Innretningen er utformet som et varmeisolert reaksjonskammer, med plass for katalysatormateriale. Temperaturen i reaksjonsområdet blir regulert ved hjelp av tilført energi. Oppvarming kan foregå med alternative varmekilder, og systemet kan derfor bruke spillvarme fra høytemperatur-prosesser som energikilde for hele – eller deler av prosessen. Innretningen har vist seg effektiv innenfor et temperaturspekter fra 400 °C til 2000 °C. Reaksjonshastighet og sluttproduktenes renhetsgrad kan kontrolleres og styres ved optimalisering av trykk og temperatur.

Videre omfatter oppfinnelsen anvendelse av kompakte pyrolysesystemer for bruk i kjøretøyer, til forprosessering av hydrokarbonholdige gasser, til drivstoff for polymere brenselsseller. Brenselcellene bruker hydrogen som drivstoff, og genererer elektrisk strøm til kjøretøyets framdrift. Både pyrolysesystemet og brenselcellene kan bygges så kompakte at de får plass i ordinære kjøretøyer.

Innretning og framgangsmåte er spesielt velegnet for bruk i miljøer der tilgangen på hydrogen og oksygen er begrenset, mens tilgangen på energi er god. Eksempler på slike miljøer er fartøyer og enheter som opererer utenfor jordens atmosfære.

Kjemisk rent karbon (carbon black) har i mange år vært et viktig industriprodukt. Store mengder blir brukt til bildekkproduksjon. Stoffet inngår også i malingsprodukter, smørremiddler og medisinske produkter. Gjennom årene har det blitt utviklet en rekke metoder for produksjon av karbon fra hydrokarbonholdige gasser. Spalting av karbon og hydrogen fra slike gasser er nå aktualisert av miljøhensyn i forbindelse med naturgassbasert produksjon av elektrisk strøm. Innen romfartsteknologien er det også interesse for hydrogenproduksjon, som et ledd i produksjon av vann til bemannede romferder/romstasjoner.

En kjent teknikk for å spalting av hydrokarboner er bruk av lysbue. Denne metoden beskrives i US.Pat. no. 5,527,518. En annen metode beskrives i US.Pat.no. 4,631,180. Begge metodene innebærer forbrenning, og gjør bruk av oksygen i produksjonen.

En metode for spalting av hydrokarboner er beskrevet i US.Pat.no. 5,198,084. Denne metoden er brukt ved gassifisering av karbonholdig materiale, og gassen oppvarmes ved hjelp av mikrobølge-teknologi, i en såkalt "plasma-reaktor".

De omtalte metodene for å skille hydrogen og karbon fra hydrokarboner gjør bruk av ulike oppvarming- og forbrenningsprosesser i atmosfærer

med oksygenunderskudd. Fremgangsmåten i følge oppfinnelsen skiller seg vesentlig ut fra disse teknikkene, ved å gjøre bruk av karbonstøv som katalysator ved spalting av hydrokarboner i et oksygenfritt miljø.

En patent DD 118263 beskriver en pyrolysemetode der karbonpartikler blir brukt som katalysator. Partiklene blir sendt gjennom hydrogenholdig gass som er oppvarmet til en temperatur på 1000 – 1800°C. Oppfinnelsen skiller seg vesentlig fra dette ved at innretning og framgangsmåte er basert på at karbonpartiklene er stillestående og samlet i et kompakt reaksjonskammer. Dette gjør at anlegget kan gjøres mye mer kompakt enn systemer med bevegelige partikler eller karbonavsetning på overflater. Den nye framgangsmåten er i tillegg vesentlig mer energieffektiv fordi pyrolyseprosessen fungerer ved temperaturer helt ned i 400°C.

Framgangsmåte og innretning, i følge oppfinnelsen, skal brukes i et prosessanlegg for produksjon av hydrogen og karbon, basert på naturgass, metan og andre organiske gasser som råstoff. Systemet er vist på prinsippskisse fig.1. Gass (1) som inneholder hydro-karboner blir ledet gjennom et filter (2), inn i et varmeisolert reaksjonskammer (3) og varmet opp ved hjelp av elektriske varmetråder (4), eller spillvarme fra andre høytemperatur prosesser. Temperaturen i reaksjonskammeret (3) blir gitt en stigende gradient i strømningsretningen (fra bunn til topp), fra 300 til maksimalt 2000 °C. Reaksjonskammeret (3) inneholder finfordelt karbonstøv (5) som fungerer som katalysator ved utskilling av fast karbon fra gassen. Karbonmolekyler i den oppvarmede gassen binder seg til karbonstøvet (5) på en slik måte at katalysatorens partikler vokser. De voksende karbon- partiklene blir skilt ut ved hjelp av et mekanisk system (eksempelvis en sentrifuge), i reaksjonskammerets nedre del (6), når

kornstørrelsen når et ønsket nivå. Innholdet av karbon i gassen får en synkende gradient oppover i reaksjonskammeret (3), og øverst består gassen hovedsakelig av hydrogen (12). Den hydrogenrike gassen, føres vider til et separasjonskammer (7) der deler av gassen blir tatt ut gjennom et membranfilter (8). Andelen av gass (9) som blir skilt ut kan optimaliseres med hensyn til hydrogenets renhetsgrad. Før lagring (10) blir gassen (9) ledet gjennom et filter (11) for fjerning av sporstoffer. Den delen av gassen (12) som ikke blir skilt ut i separasjonskammeret (3) returneres til reaksjonskammerets innmatingside.

På vei mot sporstoff-filteret (11) går den prosesserte gassen (9) gjennom en varmeveksler (13) til forvarming av innmatet gass (1). Varmeveksling mellom prosessert- og innmatet gass medfører at systemets behov for tilførte energi reduseres

Utskilling av granulert karbon skjer kontinuerlig i reaksjonskammerets nedre del (6). Ettersom katalysatorens partikler vokser og blir skilt ut, trenger systemet tilføring av nytt katalysatormateriale.

I følge oppfinnelsen blir katalysatormateriale kontinuerlig produsert ved at kontrollerte deler (15) av det utskilte karbonet (14) resirkuleres, oppmales i en mølle (16), og injiseres i reaksjonskammerets øvre del. Denne resirkulasjonsprosessen opprettholder en optimal balanse med hensyn til katalysatorpartiklenes mengde og størrelsesfordeling.

Patentkrav

1. Framgangsmåte for pyrolytisk framstilling av hydrogen og karbon fra metan og andre organiske gasser bruk av karbonstøv som katalysator for utfelling av karbon i en lukket prosess *karakterisert ved* at karbonutfellingen skjer ved at gassens blir ført gjennom et oppvarmet reaksjonskammer slik at gassens karbonmolekyler binder seg til de katalytiske partikler på en slik måte at disse stadig vokser, og mekanisk kan skilles ut når størrelsen når et forhåndsbestemt nivå.
2. Framgangsmåte for pyrolytisk framstilling av hydrogen og karbon fra metan og andre organiske gasser, i følge krav 1 og 2 *karakterisert ved* å male opp kontrollerbare mengder utfelt karbon, og returnere dette til reaksjonskammeret, i en kontinuerlig prosess, til opprettholdelse av en optimal balanse med hensyn til karbonpartiklenes mengde og størrelsesfordeling.
3. Innretning for pyrolyttisk fremstilling av hydrogen og karbon fra metan og andre organiske gasser, i et lukket system med varmeisolert reaksjonskammer *karakterisert ved at* kammeret er fylt med porøst karbonstøv med katalyttisk effekt, og at temperaturen kan kontrolleres ved tilførsel av elektrisk energi eller spillvarme fra høytemperaturprosesser.
4. Anvendelse av kompakte pyrolysesystemer, til bruk i kjøretøyer, til forprossesering av naturgass, metan og andre organiske gasser, i den hensikt å produsere hydrogen til drivstoff for polymere brenselceller, som skal generere elektrisk strøm til kjøretøyets framdrift.

Sammendrag

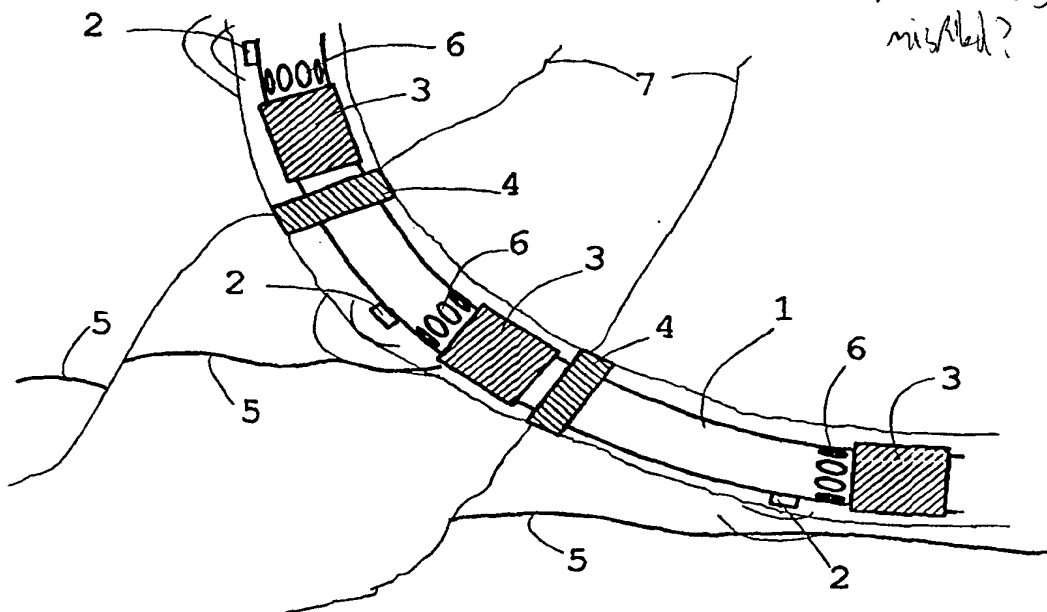
Oppfinnelsen omfatter framgangsmåte, innretning og anvendelse for pyrolyttisk framstilling av hydrogen og karbon, basert på naturgass metan- eller andre organiske gasser som råstoff. Framgangsmåten for utfelling av fast karbon er karakterisert ved å benytte finfordelt karbonstøv som katalysator i utfellingsprosessen. Innretningen er utformet som et reaksjonskammer som inneholder katalysatoren. Temperaturen i kammeret kan kontrolleres ved tilføring av elektrisk- eller annen energi. Videre omfatter oppfinnelsen anvendelse av kompakte pyrolysesystemer i kjøretøyer, til forprosessering av hydrokarbonholdige gasser, til drivstoff for polymere brenselsseller, som skal generere elektrisk strøm til kjøretøyets framdrift.



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(21) International Application Number: PCT/NO99/00185 (22) International Filing Date: 4 June 1999 (04.06.99) (30) Priority Data: 19982823 18 June 1998 (18.06.98) NO (71) Applicant (for all designated States except US): KONGSBERG OFFSHORE A.S [NO/NO]; Postboks 1012, N-3601 Kongsberg (NO). (72) Inventors; and (75) Inventors/Applicants (for US only): STEN-HALVORSEN, Vidar [NO/NO]; Prokurator Torps gt. 14, N-3600 Kongsberg (NO). STØLEN, Einar [NO/NO]; Bergsbakken 28, N-3600 Kongsberg (NO). (74) Agent: ABC-PATENT, SIVILING. ROLF CHR. B. LARSEN A.S; Brynsvn. 5, N-0667 Oslo (NO).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Norwegian).</i> (88) Date of publication of the international search report: 13 April 2000 (13.04.00)

(54) Title: SYSTEM AND METHOD FOR CONTROLLING FLUID FLOWS IN OIL OR GAS WELLS



(57) Abstract

System and method for controlling fluid flows in one or more oil and/or gas wells in a geological formation, the wells each comprising a production tube, the formation containing a water-containing volume with a higher water level, comprising: one or more measuring devices, each mounted in relation to a chosen zone of a well for measuring the distance to the water level in the zone, one or more valve devices comprised in the production tubes for regulating the fluid flow from the surrounding formation to the production tube, one or more control units connected to each of the valves for regulating then on the basis of the measured distance or distances.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 4361808 A (J.W. KERN ET AL), 30 November 1982 (30.11.82) --	1-14
A	US 4831331 A (B.R. DE ET AL), 16 May 1989 (16.05.89) --	1-14
A	US 5049037 A (G.S. CARSON ET AL), 17 Sept 1991 (17.09.91) -----	1-14

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